

Seat Belt Use among Drinking Drivers in Minnesota

ABSTRACT

Objectives. Among the reasons cited for recent declines in alcohol-related traffic fatalities is the enactment of seat belt use laws by most states. It is suspected that drinking drivers are less likely to comply with such laws, although evidence on the relationship between belt use and drinking by drivers is sparse and conflicting. The purpose of this study was to examine the relationship of drinking to driver seat belt use.

Methods. Observational, self-report, and chemical breath test data were collected on nighttime drivers in 16 Minnesota communities during September, 1990.

Results. Drivers with an illegal blood alcohol concentration (≥ 100 mg/dL) were substantially less likely to be wearing a seat belt (odds ratio [OR] = 2.17). Belt use was also more common among females (OR = 2.02) and before midnight (OR = 1.47). Males who had been drinking were less likely to be belted. Belt use was related to drinking before, but not after, midnight. Belt use was not related to drinking status among college graduates, but it was strongly related to drinking status among those with less education.

Conclusions. The present findings provide further argument for rapid implementation of passive countermeasures (airbags) and for development of creative, carefully focused interventions to target high-risk populations. (*Am J Public Health.* 1994;84:1732-1737)

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Introduction

Automobile crashes are the most common cause of unintentional injury in the United States,¹ and alcohol use plays a major role in crashes. In 1991, 38% of fatal crashes, in which 15 944 persons died, involved a driver or nonoccupant with a blood alcohol concentration greater than 100 mg/dL.² Although a variety of campaigns and initiatives during the 1980s reduced this toll from even higher levels, the loss of life from alcohol-involved crashes remains unacceptably high. Societal costs due to resulting nonfatal injuries add substantially to the economic toll due to fatal crashes.³

After the passage of mandatory belt use laws, seat belt use increases and, as a result, deaths and injuries decline.⁴⁻⁶ However, much remains to be learned about why, despite the existence of mandatory belt use laws in 48 states and the District of Columbia, belt use remains relatively low and varies widely across situations. For example, few US studies have been able to include nighttime drivers in their surveys of seat belt use, nor has it typically been possible to combine observations of seat belt use with other information about driver behavior. Thus, relatively little direct evidence exists about belt use in particularly risky driving situations, such as when driving at night or after a driver has been drinking. Self-reports and police reports of drinking and belt use by drivers involved in crashes provide some indication of belt use in these risky situations,⁷ but such evidence is confounded by problems with self-report,⁸ the need to infer belt use based on physical evidence, and the highly selective nature of the samples.

Few published studies of the general driving population have reported on belt use by drinking drivers. After New York

State enacted the first mandatory belt use law in the United States, bar patrons in New York State were found to be wearing their seat belts less frequently than other nighttime or daytime drivers,⁹ a finding replicated recently in the context of a combination seat belt and drinking-driving enforcement program conducted in a single New York community.¹⁰ Data from the Fatal Accident Reporting System indicate that, among drivers involved—though not necessarily killed—in fatal crashes, seat belt use is nearly twice as high for individuals who have no measurable blood alcohol concentration than it is for those who have a nonzero blood alcohol concentration.¹¹ Studies in Canada and the Netherlands have also found belt use to be lower among drinking drivers.^{12,13} However, a 1974 study of drivers in Kansas City (conducted before the existence of a mandatory belt use law) reported that abstainers were less likely than drinkers to be wearing a seat belt, although actual measured blood alcohol concentration was unrelated to seat belt use,¹⁴ a result similar to that found in Burlington, Vt, much more recently.¹⁵

In an effort to clarify this issue, the present study examines seat belt use by drivers and front-seat passengers sampled from the nighttime driving population

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throughout Minnesota. (Seatbelt use has been mandated in Minnesota since August 1986. The law only allows secondary enforcement; that is, drivers stopped for other offenses may be cited for failure to wear a safety belt, punishable by a \$25 fine.) These individuals were observed and interviewed during a roadside survey conducted to monitor drinking and driving. To our knowledge, this is the only study that obtained data on alcohol and seat belt use in a representative sample of nighttime drivers in a variety of locations throughout an entire state.

Methods

During 2 weeks in September 1990, voluntary interviews were conducted with 2857 drivers between the hours of 10 PM and 2:30 AM in 16 Minnesota communities. Teams of trained interviewers conducted the interviews in parking lots adjacent to roadways on both week nights and weekend nights. Respondents remained in their vehicles during the 3- to 4-minute interview and breath test sequence.

Eight of the communities surveyed were in the Twin Cities (Minneapolis–St. Paul) metropolitan area; the other eight were spread throughout the state, although most were within a 120-mile radius of the metropolitan area. On each survey night, data were collected at both an early site (10 PM to midnight) and a late site (12:30 AM to 2:30 AM). Drivers were surveyed both before and after midnight on both a weeknight and a weekend night in each community (with the exception of one community, where inclement weather forced the cancellation of the weeknight interview sessions), providing data for a total of 62 separate locations.

Survey Teams

The roadside survey operation involved four eight- or nine-person teams. Each team consisted of two law enforcement officers—a local police officer from the community being surveyed and a Minnesota State Trooper—who directed motorists off the road and into parking lots; a traffic coordinator who directed drivers into designated interview bays; four or five interviewers; and an experienced field supervisor. In addition, volunteers were on hand at each survey site to drive impaired drivers and their vehicles home if necessary.

TABLE 1—Percentage of Drivers and Passengers Observed Wearing a Seat Belt at Time of Interview

	% Drivers	% Passengers ^a	OR (95% CI)	
			Driver	Passenger
Sex				
Female	61	...	2.02 (1.72, 2.36)	...
Male	44	...		...
Education				
Less than high school	39	...	0.33 (0.24, 0.44) ^b	...
High school graduate	40	...	0.34 (0.27, 0.42) ^b	...
Some college	51	...	0.53 (0.43, 0.66) ^b	...
College graduate	66	...	...	...
Age, y				
16–20	38	...	0.57 (0.47, 0.68) ^c	...
21–24	48	...	0.82 (0.67, 1.00) ^c	...
25–34	54	...	1.06 (0.88, 1.28) ^c	...
35+	53	...	...	...
Driver BAC, mg/dL				
≤ 19	51	41	...	...
20–49	40	41	0.62 (0.42, 0.92) ^d	1.0 (0.53, 1.85) ^d
50–99	42	35	0.68 (0.48, 0.97) ^d	0.35 (0.48, 1.31) ^d
≥ 100	32	13	0.44 (0.28, 0.67) ^d	0.21 (0.09, 0.45) ^d
Vehicle type ^e				
Car/van	52	42	1.98 (1.62, 2.43)	2.95 (1.98, 4.39)
Pickup/other	36	19		
Adult passenger present				
No	51	...	1.22 (1.05, 1.43)	...
Yes	46	...		...
Time of night				
10 PM to midnight	53	41	1.47 (1.25, 1.73)	1.26 (0.98, 1.63)
After midnight	43	35		
Location				
Twin Cities	55	43	1.61 (1.39, 1.86)	1.38 (1.11, 1.72)
Outlying communities	43	35		

Note. BAC = blood alcohol concentration; OR = odds ratio; CI = confidence interval.

^aDemographic information on passengers was not collected.

^bVs college graduates.

^cVs drivers 35 or older.

^dVs 0–19 mg/dL BAC group.

^eCar (51%) and van (54%) driver belt use did not differ significantly, nor did belt use by pickup drivers (35%) differ significantly from belt use by drivers of utility vehicles (41%).

Sampling Procedure

When notified by the traffic coordinator that an interviewer was ready to begin an interview, the law enforcement officers selected the first eligible vehicle (motorcycles and commercial vehicles were not included in the sample) and directed it into the survey site. This procedure ensured an essentially random sample of drivers on the road at the time and location where the survey operation was located. The traffic coordinator then directed drivers into one of the available interview bays, using a large flashlight.

While interviewing was in progress, the number of vehicles passing the en-

trance to the survey site heading in the same direction from which vehicles were being sampled were counted with a hand counter. These counts allowed interview data to be properly weighted to reflect the volume of traffic flow at each interview site. All statistics reported below are based on data weighted by the measured traffic flow at interview locations unless otherwise noted.

Interview Procedure

As a vehicle entered an interview bay, the driver was greeted by the interviewer, who introduced herself or himself as a representative of the Minnesota

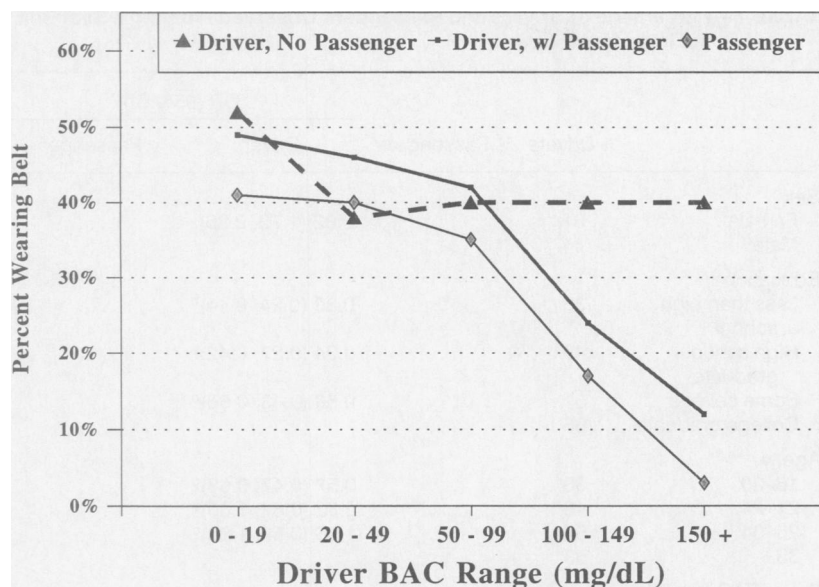


FIGURE 1—Driver and passenger seat belt use, by driver blood alcohol concentration (BAC).

Department of Public Safety. Interviewers adhered closely to a scripted introduction, and all drivers were handed a 14-cm × 21-cm card that explained the study. While drivers read or scanned the card, interviewers recorded driver sex and seat belt use, front-seat outboard passenger seat belt use, vehicle type, and whether other adults were present in the vehicle. Interviewers provided explicit assurance that the interview was voluntary and confidential before beginning the interview.

On completion of the interview, interviewers obtained a blood alcohol concentration measurement. During the first week of interviews, this measurement was obtained with a passive alcohol sensor (the CMI Alcolmeter Voice Activated Sensor).¹⁶ For persons who had a blood alcohol concentration of 20 mg/dL or greater with the passive sensor, a second measurement was taken by using an evidentiary-quality preliminary breath test device (the Intoximeter Alco-Sensor III). During the second week of interviews, all motorists were asked to provide both a passive sensor reading and the more precise measurement obtained with the preliminary breath test device. These additional data were collected to examine performance of the passive alcohol sensor in a field setting.¹⁶

Those persons whose blood alcohol concentration was below 50 mg/dL (and

who did not appear to be impaired) were thanked for their participation and reminded to drive carefully when leaving the interview site. Motorists who were discovered to have a blood alcohol concentration greater than 50 mg/dL, or who appeared to be impaired even with a blood alcohol concentration below 50 mg/dL, were driven home by an unimpaired passenger, a volunteer working with the survey team, or in a taxi cab hired by the research team. (Although the legal blood alcohol concentration limit in Minnesota is 100 mg/dL, substantial evidence indicates that many important functions related to driving are impaired at blood alcohol concentrations exceeding 50 mg/dL. Accordingly, we adopted this more conservative criterion level beyond which further driving was discouraged.)

Results

Rate of Cooperation

Ninety-six percent of the 2992 drivers asked agreed to the interview, and 98% of those who completed the interview provided a breath test, resulting in a final completion rate of 94.4% of all drivers sampled. No individual who refused to participate appeared to be legally intoxicated. Two hundred seventy individuals were found to have a blood alcohol concentration in excess of 50 mg/dL, and

all but a few of these individuals agreed to be driven home.

Predictors of Seat Belt Use

Overall belt use by drivers was 50%. Female drivers were more likely than males to be buckled up (odds ratio [OR] = 2.02; 95% confidence interval [CI] = 1.72, 2.36), as were drivers who had completed higher levels of formal education (see Table 1). The youngest drivers were less likely than older drivers to be wearing a seat belt. Drivers of automobiles and vans were more likely to be belted than were those driving pickups or utility-type vehicles (OR = 1.98; CI = 1.62, 2.43), and those driving before midnight were found to be wearing belts more often than were drivers interviewed after midnight (OR = 1.47; CI = 1.25, 1.73). Finally, drivers in the Twin Cities metropolitan area were buckled up more frequently than were drivers in the outlying communities (OR = 1.61; CI = 1.39, 1.86). Persons driving alone were somewhat more likely to be buckled up than were those with passengers, but it is important to note that this effect was due exclusively to drivers below the age of 21 (OR = 1.52; CI = 1.09, 2.12). Belt use did not vary by day of week, trip origin, or trip destination.

Seat belt use by front-seat passengers was 39%. Passenger belt use was consistently lower than driver belt use, but varied across different groups and situations in a fashion paralleling that for drivers (see Table 1).

Alcohol and Seat Belt Use

Drivers found to have an illegal blood alcohol concentration (100 mg/dL or above) were substantially less likely to be wearing their seat belts than were drivers with a low or zero blood alcohol concentration (32% vs 50%). An examination of passenger seat belt use in relation to the driver's blood alcohol concentration produced an interesting finding (see Figure 1). Passenger belt use declined as a function of the driver's blood alcohol concentration. Passengers riding with a legally intoxicated driver were nearly five times as likely to be unbelted as were passengers of nonintoxicated drivers. Interestingly, although belt use by drivers who were alone was somewhat lower among drinking drivers (i.e., those with a blood alcohol concentration of ≥ 20 mg/dL), among those drivers with a nonzero blood alcohol concentration, belt use was unrelated to their blood alcohol concentra-

TABLE 2—Percentage of Drivers above and below the Legal Blood Alcohol Concentration (BAC) Limit (100 mg/dL) and a Lower-Criterion BAC (50 mg/dL) Who Were Wearing a Seat Belt

	% below 100 mg/dL	% above 100 mg/dL	OR ^a (95% CI)	% below 50 mg/dL	% above 50 mg/dL	OR ^b (95% CI)
Sex						
Male	45	24	2.57 (1.61, 4.11)	46	32	1.81 (1.33, 2.46)
Female	61	66	0.79 (0.32, 1.95)	61	58	1.14 (0.67, 1.95)
Education						
Less than high school	39	15	3.77 (0.28, 51.15)	40	11	5.26 (1.00, 27.54)
High school graduate	41	20	2.87 (1.45, 5.67)	42	31	1.60 (1.05, 2.43)
Some college	52	31	2.43 (1.28, 4.63)	53	37	1.90 (1.23, 2.93)
College graduate	66	78	0.55 (0.17, 1.81)	66	64	1.11 (0.57, 2.15)
Age, y						
16–20	38	10	5.42 (0.82, 35.69)	39	18	3.00 (1.21, 7.44)
21–24	50	37	1.67 (0.76, 3.68)	50	39	1.55 (0.88, 2.71)
25–34	56	35	2.31 (1.26, 4.24)	56	46	1.45 (0.96, 2.21)
35+	53	29	2.85 (1.30, 6.24)	54	32	2.52 (1.52, 4.19)
Vehicle type						
Car/van	53	35	2.13 (1.34, 3.38)	53	41	1.62 (1.21, 2.17)
Pickup/other	36	26	1.57 (0.72, 3.43)	36	27	1.58 (0.87, 2.85)
Time of night						
10 PM to midnight	53	29	2.76 (1.47, 5.20)	53	40	1.73 (1.18, 2.52)
12:30–3 AM	43	37	1.29 (0.76, 2.18)	44	37	1.35 (0.92, 1.98)
Location						
Twin Cities	55	46	1.47 (0.86, 2.51)	56	46	1.49 (1.02, 2.16)
Outlying	44	20	3.28 (1.75, 6.13)	45	31	1.83 (1.26, 2.64)

^aLikelihood of wearing a safety belt for those drivers with a BAC below 100 mg/dL vs those with a BAC above 100 mg/dL.

^bLikelihood of wearing a safety belt for those drivers with a BAC below 50 mg/dL vs those with a BAC above 50 mg/dL.

tion. That is, there appears to be a threshold effect rather than a dose-response relationship among drivers who were alone in the vehicle. Among both passengers and drivers with passengers, however, there is a clear dose-response relationship between blood alcohol concentration and seat belt use.

Driver blood alcohol concentration also interacted with several other predictors of seat belt use (see Table 2). Legally intoxicated males were substantially less likely to be wearing a seat belt than were those whose blood alcohol concentration was below the legal limit (24% vs 45%). Belt use by legally intoxicated females was not meaningfully lower than belt use among females who had been drinking little or nothing. A more detailed analysis, with blood alcohol concentrations grouped into several categories, indicated that seat belt use by female drivers was unrelated in any way to blood alcohol concentration.

Educational level interacted with blood alcohol concentration to predict belt use. Among persons with less than a college degree, belt use by persons with a blood alcohol concentration above the legal limit was consistently about half that of persons with a blood alcohol concentration below the limit (see Table 2).

Although the difference for persons with less than a high school degree is not statistically significant, the odds ratio is quite similar to that for high school graduates; this failure to reach a conventional level of statistical significance is due to the small number of persons in that group with an illegal blood alcohol concentration ($n = 5$). In contrast, among college graduates, belt use was actually more common (though not to a statistically significant degree) in individuals who were legally intoxicated.

Examining driver age, we found that seat belt use was significantly related to blood alcohol concentration only among persons above the age of 24. This effect was more pronounced among persons above the age of 34, for whom driving after heavy drinking was substantially less common. For all vehicle types, seat belt use was substantially greater among persons whose blood alcohol concentration was below the legal limit. This difference is statistically significant at a conventional confidence level only among drivers of passenger cars or vans. Belt use by drivers of pickups and utility-type vehicles was consistently less common than it was among drivers of cars or vans, but showed

a lesser, nonsignificant drop among legally intoxicated drivers.

There was a substantially greater difference in belt use between legally intoxicated and nonintoxicated drivers before midnight ($OR = 2.76$) than was found after midnight ($OR = 1.29$). Late-night belt use was generally lower (see Table 1), but this pattern did not hold among legally intoxicated drivers. Belt use after midnight by legally intoxicated drivers was actually somewhat higher (29% before vs 37% after), although this difference is not statistically significant ($P > .25$).

Finally, there was a much greater difference in belt use between legally intoxicated and nonintoxicated drivers in the outlying communities ($OR = 3.28$) than was found in the Twin Cities metropolitan area ($OR = 1.47$). Both intoxicated and nonintoxicated drivers in the Twin Cities area had consistently higher levels of belt use than drivers in the outlying areas.

Seat Belt Use among Drivers with Lower Blood Alcohol Concentrations

All the analyses reported above were also conducted to compare persons with blood alcohol concentrations above and

below 50 mg/dL, a level at which impairment is common, and which represents the legal alcohol limit in a number of countries. Although the magnitude of the differences varied, the findings were essentially the same as those reported above (see Table 2).

Discussion

Drivers who increased their risk of crash involvement by consuming alcohol before driving also tended to be at higher risk of serious injury in the event of a crash due to their lower rate of seat belt use. This risk is even further compounded by the potentiating effects of alcohol.¹⁷ Compared with drivers who were not intoxicated, legally intoxicated drivers were about a third less likely to be wearing a seat belt. There were significant exceptions to this finding, however, among females and college graduates, for whom seat belt use was unrelated to alcohol use. In addition, although belt use was lower among drinking drivers, it did not decline further at higher blood alcohol levels among drivers who were alone. Belt use did decline further with increasing blood alcohol concentration for drivers with passengers. The largest differences in seat belt use between intoxicated and nonintoxicated drivers were found among drivers under 21 or over 34 years of age and among persons driving outside the Twin Cities metropolitan area.

The present study also provides unique information concerning seat belt use by right-front-seat passengers. In general, passengers were less likely than drivers to be using their belts and passenger belt use declined, as did belt use by drivers with passengers, as a function of increasing blood alcohol concentration in the driver. Passengers who were riding with a legally intoxicated driver were less likely to buckle up than those riding with a nondrinking driver, an interesting finding given the known increased risk of a crash that accompanies drinking and driving.

To our knowledge, seat belt use by passengers has not previously been reported as a function of driver blood alcohol concentration. If the present findings are representative of other regions of the country—and there is no obvious reason to think they are not—the results are especially distressing. Not only are passengers placed at greater risk of a crash by riding with an intoxicated driver, they are also at risk of serious injury in the event of a crash by virtue of not wearing seat belts. This is an especially serious

concern for adolescent passengers, who report riding with a drinking driver far more often than being a drinking driver themselves.¹⁸ Teenagers report that they often perceive few if any alternatives to riding with a driver who has been drinking.¹⁹ Although they could substantially reduce their risk of injury in such situations by wearing a seat belt, the present findings suggest that they do not generally do so. This may be due in part to the fact that they also have been drinking, although we know of no empirical data on blood alcohol concentrations among automobile passengers that might support this supposition. This effect would appear to be more a result of the generally low rate of belt use among adolescents.

It is of special concern that those subgroups (e.g., males, younger drivers) who are most likely to be involved in crashes and who do more of the nighttime driving were less likely to be wearing their seat belts. Moreover, these same groups were most likely to be legally intoxicated and to have the greatest decrease in belt use among those who were intoxicated. This finding helps to explain why, despite the documented effectiveness of seat belts in reducing injury severity and death, the overall decline in serious injuries and fatalities after enactment of mandatory belt use laws has been less dramatic than might have been expected.

It is clear that individuals who drive while intoxicated are not responsive even to high-profile traffic safety laws such as those pertaining to driving after drinking; therefore, they are not likely to be motivated to buckle up by the existence of a belt use law that carries a far less serious penalty. Safety devices that do not rely exclusively on individuals taking responsibility for their own safety (e.g., airbags, automatic seat belts) probably hold the greatest promise for reducing injuries and fatalities among this group of drivers as well as their passengers, although both airbags and many automatic seat belt systems reach their maximum potential effectiveness only when accompanied by active belt use as well.

Until air bags become widespread throughout the vehicle fleet, which will be in the next century, there remains an urgent need for creative interventions to increase seat belt use among this high-risk population. Although one recent attempt failed to demonstrate any effect of a safety belt intervention targeted specifically toward young males,²⁰ other efforts to improve belt use among high-risk rural populations have proved to be more

successful.²¹ We are unaware of any program, however, that has attempted to address belt use among teenage drinking drivers or passengers of drinking drivers.

A potentially important methodological implication of the finding that belt use is unrelated to blood alcohol concentration among females is that studies based on data from fatal crashes will likely underestimate the extent to which women are drinking and driving. Because of the protective value of safety belts, a smaller proportion of women's crashes will be fatal crashes. This should be especially true for the late-night, single-vehicle crashes that are used as proxies for alcohol-related crashes, because the majority of these involve no passengers; the only person who can die, thereby rendering the crash an alcohol-related fatal crash, is the driver.

Some caution should be exerted in interpreting the present findings because they reflect only nighttime drivers from a single state. (The present finding of 32% restraint use among legally intoxicated drivers is comparable to the 28% use found among drivers with a blood alcohol concentration in excess of 100 mg/dL in the 1986 National Roadside Survey.²²) Nonetheless, the complex interrelationships that appeared between seat belt use and the several factors, including drinking, examined in the present study suggest that additional research is sorely needed. It would appear that the development of successful interventions to motivate belt use will be difficult until we have a better grasp of the way in which a variety of factors enter into decisions regarding whether and when to buckle up. Although we know that younger drivers, pickup drivers, males, less-educated drivers, and drinking drivers are less likely to wear their seat belts, it will likely be difficult to induce these individuals to do so without a more refined understanding of why they currently do not buckle up, despite laws that mandate belt use. That very high rates of belt wearing have been achieved in other countries suggests that sociocultural factors are at work,²³ and these will need to be dealt with if we are to reach high levels of belt use in the United States.²⁴

Two other characteristics of the present study also suggest caution in interpreting the results. Based on reports from interviewers and our own experience with this and other similar surveys, it is possible that occupants either buckled or unbuckled their belts only on encountering the survey team, although we do not

believe this occurred often. In addition, the survey sites were selected to meet the logistical requirements of space, safety, and sufficient traffic flow rather than randomly—as is always the case in roadside surveys of alcohol use. There was no attempt to select locations that would produce a disproportionate number of drinking drivers. Although neither residential streets nor freeways were used for surveys, we believe that the sites selected provide a reasonable representation of nighttime traffic in the communities surveyed. □

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